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Abstract

Within the prevailing consensus on sustainable development, energy efficiency exhibits pronounced spatial externalities. The intertwining of national policy resources has generated a rapidly expanding yet increasingly balanced global low-carbon collaborative governance network (GTFEN).This study examines the structural properties of the GTFEN to analyze empirical characteristics of low-carbon collaborative governance using a three-tier indicator system. It employs a temporal exponential random graph model to map the spatial pattern and drivers of GTFEN.The findings reveal that economies with limited green technology innovation or low environmental taxes continue to participate in low-carbon collaboration and assume distinct governance roles. The network is strongly homophilous in carbon productivity, with weak-tie bridges and preference for degree uniformity influence link formation.Heterogeneity tests reveal that higher environmental taxes most effectively spur cooperation among resource-rich countries, whereas gains in carbon productivity and environmental tax revenue foster the integration of developed economies.The study conclusions present important implications for worldwide green transformation: it is imperative to deepen transnational policy coordination and technology-sharing mechanisms to dismantle technological barriers and build an equitable global low-carbon governance network, while simultaneously strengthening the policy leadership of developed economies.